

Oxygen Measurement in Vapor Recovery Units and Flare/Vent Headers

Tunable Diode Laser Spectrometer | TDLS8000/TDLS8220

Boost vapor recovery system efficiency and safety with Yokogawa's TDLS8000 and TDLS8220. Our interference-free oxygen analyzers monitor with direct measurements to ensure minimal upkeep and secure operations without system shutdowns versus traditional oxygen analyzer technologies.

Process Background

Across many different industries including Oil & Gas, Chemical, Petrochemical, and many others, vapors build up in chemical storage tanks due to flashing (volatile components vaporizing from their liquid state) when new feedstock is introduced, pressure changes from level and/or agitation, and temperature changes. Vented vapors, typically collected through a vent header system, often containing VOCs (Volatile Organic Compounds) or other flammable components, are also commonly generated in different production processes and chemical production reactions. The generated vapors can either be recovered through the use of a VRU (Vapor Recovery Unit) to be compressed back into liquid form or sent to a VCU (Vapor Combustion Unit) to be incinerated, similar to a flare. Vapor Recovery Units (VRUs) were developed to help recover valuable or hazardous chemicals which may have been traditionally incinerated or vented to the atmosphere. It's common, for example in Marine Vapor Recovery, to have strict regulations for Marine Vapor



Example: Storage of liquid chemical and petrochemical products tanks



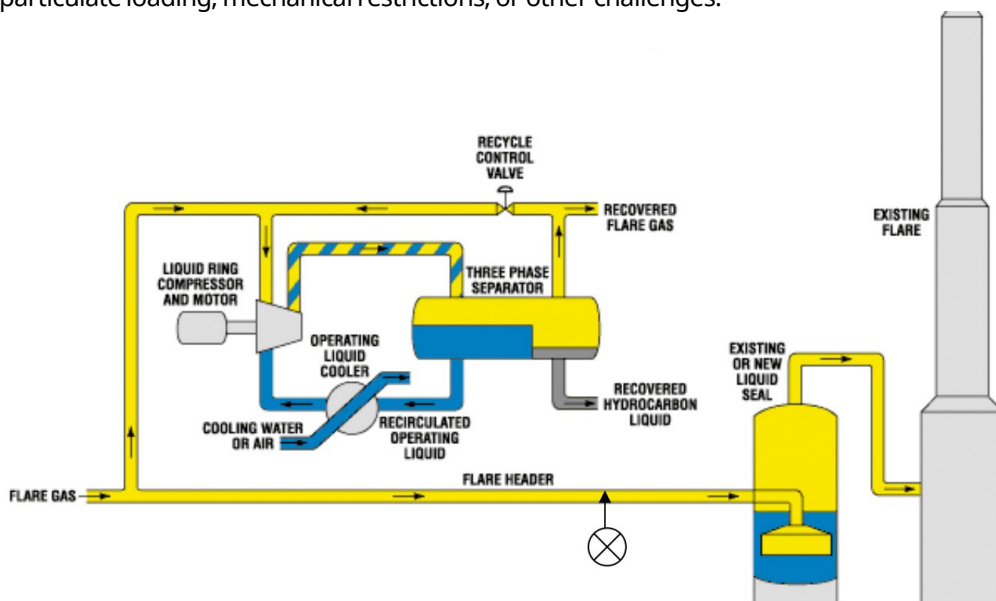
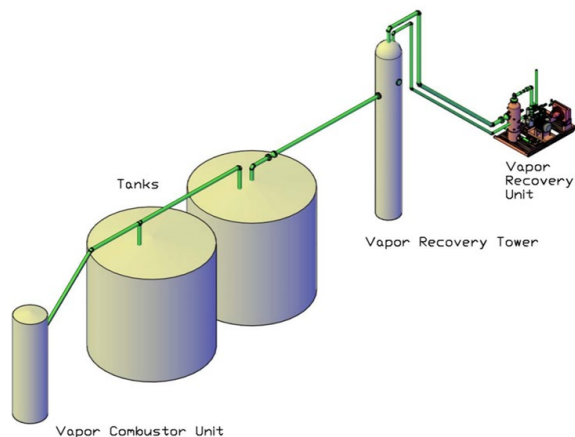
Vapor Recovery Unit (VRU)

Control Systems to safeguard personnel and equipment by containing and controlling vapor emissions during tanker loading. In the crude refinery sector VRUs have a high hydrocarbon recovery rate of greater than 95% and in general a payback period of less than one year.

Measurement Overview

An online, continuous oxygen gas measurement is needed to verify the oxygen content remains below the LOC (Limiting Oxygen Concentration) to prevent ignition of the mixture in the transportation, recovery, or destruction steps in

vapor recovery and flare/vent headers. The oxygen measurement is typically tied to a safety shut down system to purge the process line/system with nitrogen during unsafe conditions. An in-situ analysis is typically preferred as it reduces overall system complexity and cost by eliminating the requirement of a SHS (Sample Handling System) and yields better measurement response time than an extractive analyzer. Although in-situ is preferred, there are scenarios where in-situ is not possible: process pressure and temperature limitations, line size restrictions to achieve adequate analysis accuracy, high particulate loading, mechanical restrictions, or other challenges.



Oxygen measurement at the flare line and the recovery drum/storage container (not pictured), using the TDLS.

Solution

Traditionally, oxygen measurements have been made using an extractive paramagnetic analyzer. The paramagnetic measurement is susceptible to error when the sample background changes due to diamagnetic and paramagnetic interference from other molecules. Generally, if the interfering molecule(s) concentration is steady, this effect can be minimized with a zero offset, but the danger being these process lines don't regularly have a defined "normal" composition and the zero offset is only valid for "normal" operation. The oxygen measurement is required to monitor continuously, even during upset conditions outside of steady state. Accuracy may be lost when it is needed the most leading to unsafe conditions and/or product quality and yield degradation. Yokogawa's TDLS8000 platform can provide an in-situ, SIL certified oxygen measurement in vapory recovery and flare/vent headers. The flexibility of the TDLS8000 means it can be installed in a variety of in-situ options, Bypass Configuration, Bend Configuration, and Cross Stack Configuration, each yielding advantages and disadvantages (please refer to [Yokogawa's Process Gas Measurement Addendum](#)

for detail on each methodology). If an in-situ installation is still not achievable, Yokogawa's TDLS8220 provides an extractive, drop-in replacement for legacy oxygen analyzers utilizing a TDLS with integrated flow cell, purge control, heat trace, insulation, and active pressure/temperature compensation all pre-packaged with SIL certified components for installation in a Safety Instrumented System. Yokogawa's TDLS8000 and TDLS8220 offer an interference free measurement, increased reliability, lower long-term cost of ownership, advanced diagnostics, and isolation of sensitive components during SHS failure or process upsets versus traditional oxygen analyzer technologies.



TDLS8000



TDLS8220

Key Benefits

- No sampling system operation
- In-situ analysis removes complex sample systems for improved response time
- Interference free analysis
- Reduced routine maintenance
- SIL2 Certified, SIL3 Capacity TruePeak combined with smart laser Technology
- Advanced diagnostics with 50 days of data and spectra storage
- Analyzer, flow cell, heat trace control, insulation, purge control, and wiring termination pre-integrated
- Drop-in replacement for existing analyzer technologies
- Integrated tube-in-shell flow cell allows for tight sample heating control
- Pressure and temperature compensation included

OpreX™ Yokogawa achieves operational excellence by providing products, services, and solutions based on the OpreX comprehensive brand that cover everything from business management to operations.

Trademarks Co-innovating tomorrow, OpreX and all product names of Yokogawa Electric Corporation in this bulletin are either trademarks or registered trademarks of Yokogawa Electric Corporation. All other company brand or product names in this bulletin are trademarks or registered trademarks of their respective holders.

YOKOGAWA ELECTRIC CORPORATION
World Headquarters

9-32, Nakacho 2-chome, Musashino-shi, Tokyo 180-8750, JAPAN

<http://www.yokogawa.com>



YOKOGAWA CORPORATION OF AMERICA
YOKOGAWA EUROPE B.V.
YOKOGAWA ENGINEERING ASIA PTE. LTD.
YOKOGAWA CHINA CO., LTD.
YOKOGAWA MIDDLE EAST & AFRICA B.S.C.(c)

<http://www.yokogawa.com/us/>
<http://www.yokogawa.com/eu/>
<http://www.yokogawa.com/sg/>
<http://www.yokogawa.com/cn/>
<http://www.yokogawa.com/bh/>